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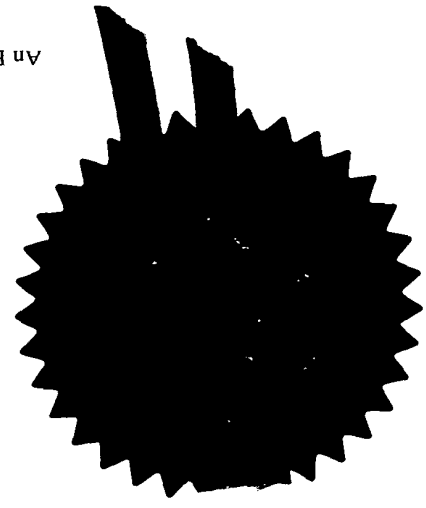
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J. Horgan

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Dated

11 MAY 2000



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(See note (d))

c) any named applicant is a corporate body;

applicant, or

b) there is an inventor who is not named as an

a) any applicant named in part 3 is not an inventor, or

this request? (Answer 'Yes' if:

8. Is a statement of inventorship and of right to grant of a patent required in support of

Yes

the earlier application

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Country

Priority application number

Date of filing (day / month / year)

agents ADP number (if you know it)

I792001

(including the postcode)

5. Name of your agent (if you have one)

Wynne-Jones, Laine & James

22 Rodney Road
Cheltenham
Gloucestershire GL50 1JJ

4. Title of the invention

Gas Delivery System

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

5534151002

Patents ADP number (if you know it)

NP1-9UJ

Gwent

Newport

Imperial Park

Surface Technology Systems Limited

3. Full name, address and postcode of the or of each applicant (underline all surnames)

4 MAR 1999

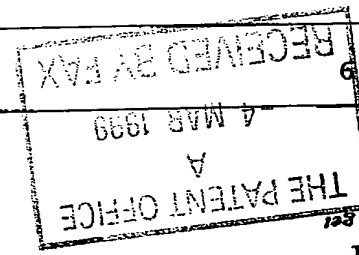
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2. Patent applicant (The Patent Office)

1. Your reference

SCE/NS/STS 29

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form
 Description

Claim(s)
 Abstract

Drawing(s)

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. I/we request the grant of a patent on the basis of this application.

Signature *Wynne-Jones, Laine & James* Date *4th March 1999*

12. Name and daytime telephone number of person to contact in the United Kingdom
 Mr. S.C. Eastwood (01242) 515807

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Gas Delivery System

This invention relates to a gas delivery system, particularly, although not exclusively, one for use in a plasma processing apparatus, for example one in which a switched etch/deposition cycle or continuous process is used on a semiconductor wafer or the like.

Dry process continuous and switched etch/deposition processes uses sulphur hexafluoride as the standard etch chemistry. The industry demands for higher etch rate processes have led to the investigation of alternative process etch gases which allow an increase in the density of active species in the process chamber resulting in improved process rates.

Several different chemistries are known to be likely candidates to enhance the process rate. All suffer from increased cost, greater health and safety risks and poor commercial availability. These factors combine to make the economics of implementing these chemistries extreme and/or the installation too hazardous. Latterly, a number of molten electrolyte gas generators have been reported and are just being made commercially available. These gas generators include fluorine, nitrogen trifluoride and chlorotrifluoride. They are able to generate the process gases to high purity and at a reasonable cost and risk. The gas generators contain a solid when cold and this allows for safe transportation and storage of the units.

The incorporation of these gas generators into a gas delivery system local to the process chamber allows a novel capability to introduce different processes gases into a variety of process schedules to achieve a process advantage. There are many novel aspects to the application of these gas generators to a dry processing environment in terms of system design, gas delivery control, system transportation, ease of installation and process advantages.

Thus, according to a first aspect of the present invention there is provided an apparatus for treating a substrate, the apparatus comprising a chamber, a support for a substrate and delivery system for delivering an etching and/or deposition gas into the chamber, wherein the delivery system is positioned locally to the chamber.

"Locally" means that the delivery system is associated with a particular apparatus rather than being a central supply for a number of apparatuses.

According to a second aspect of the present invention, there is provided a method of treating a substrate comprising providing an etch and/or deposition gas to a chamber in which the substrate is situated, wherein the gas is delivered from a delivery system positioned locally to the chamber.

According to a third aspect of the present invention, there is provided a method of treating a substrate comprising cyclically performing the following steps:

- a) etching the substrate with a gas;
- b) depositing a passivation layer on the surface of an

etched feature; and
 c) selectively removing the passivation layer from the
 etched feature,
 wherein the etching gas comprises fluorine, nitrogen
 trifluoride or chlorotrifluoride or mixtures thereof.
 Indeed, the gases can be mixed with SF_6 or other known
 gases.

Safety issues compared to the conventional cylinder
 delivery:

10 1. The generators operate at atmospheric pressure
 eliminating the need for high pressure regulators on the
 system.
 2. There is no potentially hazardous gas in the system
 until the user demands production eliminating hazardous
 storage problems. The risks to operators are significantly
 reduced.

3. At room temperature the gas generators have a solid
 constitution eliminating the risks of transporting the
 hazardous gas on site or to the working location.
 4. The local delivery on demand eliminates long gas lines
 from a central store on the installation and the associated
 risks of hazardous gases in these pipes.

Reduced cost of installation of the gas generators
 compared to conventional cylinder delivery.

25 1. The local delivery system eliminates the expense to add
 additional long gas lines from a central store on the
 installation to the processing environment.

2. The production of the process gas from the generator is typically comparable to the high pressure cylinders.
3. The close proximity to the process equipment minimises the safety precautions needed to protect the operator during any maintenance operations.

Features of this novel use of the gas generators may be:

1. A totally dry method of heating the electrolyte instead of the normal hot water bath.

2. The gas generators produce a gas at both the anode and the cathode of the electrolytic cell. The two gases are potentially extremely reactive but are separated by the design of the system to avoid any possible recombination.

3. The gas generators are only designed to be operated at atmospheric pressure. The design of the gas line to the process chamber incorporates a novel control system such that the generator does not see the low pressure (vacuum) at the process chamber. This is an important design feature of the gas generators operation on the overall system.

4. Included in the local delivery system is the ability to polish the generated gas to remove unwanted impurities before passing into the process chamber.

It is envisaged that the invention can be used in our following co-pending applications:

1. Continuous operation dry processing (British Patent Application No. 9805927.2). The gas generator can be used to

supply a process gas to etch substrates placed in the process chamber. This may involve the use of a plasma to generate the reactive species or without a plasma where the generated gas reacts spontaneously with the substrate.

2. Alternative gas for the switched plasma process (EP-A-0822584 and EP-A-0822582). The addition of the generated gas allows the replacement or addition to the existing process etch gas used in the switched plasma process. The generated gas e.g. Fluorine or nitrogen trifluoride can be advantageously used to enhance the process etch rate either individually or in combination with the existing sulphur hexafluoride.

3. Alternative gas for the plasma-less switched process (British Patent Applications Nos. 9815931.2 and 9823364.6). Where the generated gas spontaneously reacts with the substrate, substitution of the sulphur hexafluoride process gas will also allow the operation of the process without plasma in the process chamber.

In addition, it is envisaged that the invention can be used in the generation of gases for a plasma/plasma-less switched process similar to that in British Patent Application Nos. 9815931.2 and 9823364.6. The ability to generate gases or combine gas mixtures which either require a plasma to produce the reactive species or spontaneously react with the substrate, allows the capability to introduce a process schedule which may only require a plasma for one or other of the process steps in the overall process schedule.

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